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VLBI Observations of the Gravitational Lens B1422+231

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Abstract. We present results from VLBI observations of the gravitational lens B1422+231. All the four images of this system have been detected and appear unresolved at 18cm. Images A and B show elongated structures at 6cm with 1 mas resolution. With a resolution of 0.75 mas at 2cm, three images are elongated with axial ratios of about 10:1 for A and B, and 2:1 for C.

1. Introduction

The gravitational lens system B1422+231 consists of 4 images with maximum image separation of 1.3 arcsec (Patnaik et al. 1992). It is associated with a 15.5mag quasar at z=3.62. The flux ratios of images A, C and D with respect to B are 1.0, 0.5, 0.02. The images have similar fractional polarization as well as similar PA of polarization. Recent HST observations detect all 4 images as well as the lensing galaxy and the spectra of the images are virtually identical (Impey et al. 1996).

2. Observations and Results

Global MK3 observations at 18cm and 6cm were made in 1991/2; 6cm maps are given in Patnaik & Porcas (1996). New 2cm observations were made with the VLBA on 1995 May 26. A total of 64 MHz bandwidth was used in a single polarization. The data were analyzed using the NRAO AIPS software package.

It is rather remarkable that the images A and B are elongated by about 10:1 while image C is elongated by 2:1. The deconvolved sizes are A: 2.35×0.27 mas at 57°; B: 2.90×0.26 mas at 45°; C: 1.30×0.56 mas at 27°. Of particular interest is the PA of these elongations as they form an arc, which is expected from an elliptical lens. Thus we believe that most of the elongation is due to "tangential stretching" rather than internal structure of the radio source.

The flux ratios (Table 1) derived from these 2cm observations compare well with results from other radio frequencies. There is significant difference in the flux ratio of image A at IR and optical bands with respect to radio bands. It is possible that this image is affected by microlensing which can affect the optical and IR structures much more than the radio.

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References

Impey, C. D. et al. 1996. *ApJ*, **462**, L53–57.

Lawrence, C. R. et al. 1992. *MNRAS*, **259**, 5–7p.

Patnaik, A. R. et al. 1992. *MNRAS*, **259**, 1–4p.

Patnaik, A. R., & Porcas, R. W. 1996. in *Astrophysical Applications of Gravitational Lensing: IAU Symp. 173* eds. C. S. Kochanek & J. N. Hewitt (Dordrecht: Kluwer), 305–310.

Component	18cm	6cm	2cm	IR	Opt. Cont.	Lyα
A	1.02	0.96	1.00	0.78	0.78	0.90
B	1.00	1.00	1.00	1.00	1.00	1.00
C	0.59	0.47	0.49	0.49	0.50	0.49
D	0.023	0.08	0.03	0.06	0.025	0.027

Table 1. Flux ratios of the images with respect to image B at several wavelengths. The radio flux ratios are from global VLBI and VLBA observations. Optical flux ratios are from Impey et al. (1996), IR values are from Lawrence et al. (1992).

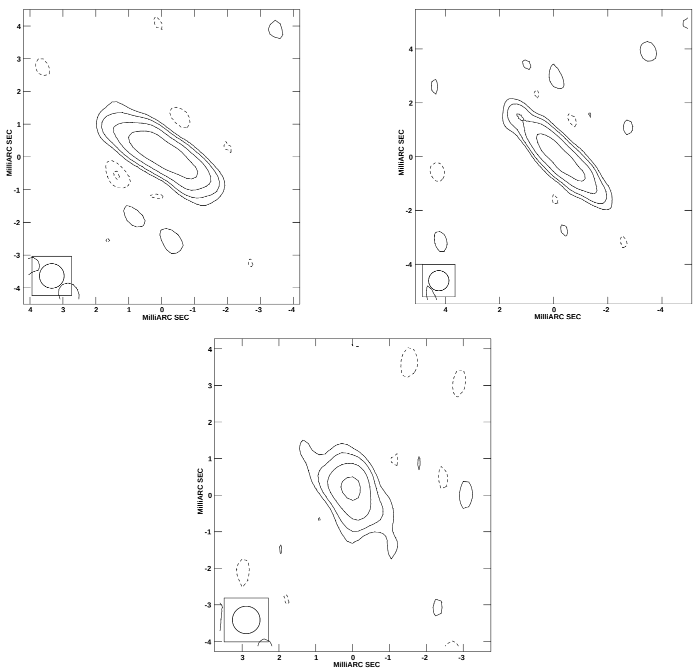

Figure 1. VLBA maps of B1422+231 A (top left), B (top right) and C (bottom) at 15GHz with a resolution of 0.75 mas. Image D is detected only in natural weighted maps. The restoring beam is plotted at the lower left hand corner of each map. Contour levels are in 1.5mJy/beam $\times$ -2,-1,1,2,4,8,16,32.